

**A2.A.19: Properties of Logarithms 1: Apply the properties of logarithms to rewrite logarithmic expressions in equivalent forms**

1 The expression  $\log 12$  is equivalent to

- 1)  $\log 6 + \log 6$
- 2)  $\log 3 + 2 \log 2$
- 3)  $\log 3 - 2 \log 2$
- 4)  $\log 3 \cdot \log 4$

2 The expression  $\log 4x$  is equivalent to

- 1)  $\log x^4$
- 2)  $4 \log x$
- 3)  $\log 4 + \log x$
- 4)  $(\log 4)(\log x)$

3 Which expression is *not* equivalent to  $\log_b 36$ ?

- 1)  $6 \log_b 2$
- 2)  $\log_b 9 + \log_b 4$
- 3)  $2 \log_b 6$
- 4)  $\log_b 72 - \log_b 2$

4 The expression  $\log 4m^2$  is equivalent to

- 1)  $2(\log 4 + \log m)$
- 2)  $2 \log 4 + \log m$
- 3)  $\log 4 + 2 \log m$
- 4)  $\log 16 + 2 \log m$

5 If  $A = \pi r^2$ ,  $\log A$  equals

- 1)  $2 \log \pi + \log r$
- 2)  $\log \pi + 2 \log r$
- 3)  $2 \log \pi + 2 \log r$
- 4)  $2 \pi \log r$

6 If  $2x^3 = y$ , then  $\log y$  equals

- 1)  $\log(2x) + \log 3$
- 2)  $3 \log(2x)$
- 3)  $3 \log 2 + 3 \log x$
- 4)  $\log 2 + 3 \log x$

7 If  $L = \frac{x^2}{k}$ , then  $\log L$  is equal to

- 1)  $2 \log \frac{x}{k}$
- 2)  $2(\log x - \log k)$
- 3)  $2 \log x - \log k$
- 4)  $\frac{2 \log x}{\log k}$

8 The expression  $\log \frac{b^3}{a}$  is equivalent to

- 1)  $3(\log b - \log a)$
- 2)  $\log 3b - \log a$
- 3)  $3 \log b - \log a$
- 4)  $\frac{3 \log b}{\log a}$

9 If  $u = \frac{x}{y^2}$ , which expression is equivalent to  $\log u$ ?

- 1)  $\log x + 2 \log y$
- 2)  $2(\log x - \log y)$
- 3)  $2(\log x + \log y)$
- 4)  $\log x - 2 \log y$

10 If  $T = \frac{10x^2}{y}$ , then  $\log T$  is equivalent to

- 1)  $(1 + 2 \log x) - \log y$
- 2)  $\log(1 + 2x) - \log y$
- 3)  $(1 - 2 \log x) + \log y$
- 4)  $\log(1 - 2x) + \log y$

11 The expression  $\log \sqrt{xy}$  is equivalent to

- 1)  $2 \log x \log y$
- 2)  $2(\log x + \log y)$
- 3)  $\frac{1}{2} \log x \log y$
- 4)  $\frac{1}{2} (\log x + \log y)$

12 If  $x = (8^2)(\sqrt{5})$ , which expression is equivalent to  $\log x$ ?

- 1)  $2 \log 8 + 2 \log 5$
- 2)  $2(\log 8 + \frac{1}{2} \log 5)$
- 3)  $2 \log 8 + \frac{1}{2} \log 5$
- 4)  $(2 \log 8)(\frac{1}{3} \log 5)$

13 If  $x = \frac{a\sqrt{b}}{c}$ , then  $\log x$  is equal to

- 1)  $\log a + \frac{1}{2} \log b - \log c$
- 2)  $\log a + 2 \log b - \log c$
- 3)  $\log a - \frac{1}{2} \log b + \log c$
- 4)  $\log a - 2 \log b - \log c$

14  $\text{Log} \frac{\sqrt{xy}}{z}$  is equal to

- 1)  $\frac{1}{2} \log x + \frac{1}{2} \log y - \log z$
- 2)  $\frac{1}{2} \log x + \log y - \log z$
- 3)  $\frac{1}{2} (\log x + \log y - \log z)$
- 4)  $\frac{\frac{1}{2} \log xy}{\log z}$

15 The expression  $\log \frac{\sqrt{xy}}{w}$  is equivalent to

- 1)  $\frac{2 \log xy}{\log w}$
- 2)  $\log x + \log y - \log w$
- 3)  $\frac{1}{2} (\log x + \log y) - \log w$
- 4)  $\frac{1}{2} (\log xy - \log w)$

16  $\text{Log} \sqrt{\frac{a}{b}}$  is equivalent to

- 1)  $\frac{1}{2} \log a - \log b$
- 2)  $\frac{1}{2} (\log a - \log b)$
- 3)  $\frac{1}{2} (\log a + \log b)$
- 4)  $\frac{1}{2} \log a + \log b$

17 The expression  $\log \left( \frac{x^n}{\sqrt{y}} \right)$  is equivalent to

- 1)  $n \log x - \frac{1}{2} \log y$
- 2)  $n \log x - 2 \log y$
- 3)  $\log(nx) - \log \left( \frac{1}{2} y \right)$
- 4)  $\log(nx) - \log(2y)$

18 The expression  $\log \left( \frac{x^2 y^3}{\sqrt{z}} \right)$  is equivalent to

- 1)  $\frac{(2x)(3y)}{\frac{1}{2}z}$
- 2)  $2 \log x + 3 \log y + \frac{1}{2} \log z$
- 3)  $\log 2x + \log 3y - \log \frac{1}{2}z$
- 4)  $2 \log x + 3 \log y - \frac{1}{2} \log z$

19 The expression  $\log \frac{\sqrt{x^2 y^3}}{z}$  is equivalent to

- 1)  $\frac{1}{2}(2 \log x + 3 \log y - \log z)$
- 2)  $\frac{1}{2}(2 \log x + 3 \log y) - \log z$
- 3)  $2 \log x + 3 \log y - \log z$
- 4)  $\frac{x^2 y^3}{z}$

20 The expression  $\log \frac{\sqrt[3]{a}}{b}$  is equivalent to

- 1)  $\frac{1}{3} \log a - \log b$
- 2)  $\frac{1}{3} \log(a - b)$
- 3)  $3 \log a - \log b$
- 4)  $3 \log(a - b)$

21 If  $r = \sqrt[3]{\frac{A^2 B}{C}}$ , then  $\log r$  can be represented by

- 1)  $\frac{1}{6} \log A + \frac{1}{3} \log B - \log C$
- 2)  $3(\log A^2 + \log B - \log C)$
- 3)  $\frac{1}{3} \log(A^2 + B) - C$
- 4)  $\frac{2}{3} \log A + \frac{1}{3} \log B - \frac{1}{3} \log C$

22 The equation  $N = \frac{\sqrt[4]{x^2 y}}{z}$  is equivalent to

- 1)  $\log N = \frac{1}{4}(2 \log x + \log y - \log z)$
- 2)  $\log N = \frac{1}{4}(2 \log x + \log y) - \log z$
- 3)  $\log N = \frac{1}{4} \log 2x + \frac{1}{4} \log y - \log z$
- 4)  $\log N = \frac{2}{4} \log x + \frac{1}{4} \log(y - z)$

23 The expression  $\log \sqrt[4]{\frac{a^2}{b}}$  is equivalent to

- 1)  $\frac{1}{4} \left( \frac{\log a^2}{\log b} \right)$
- 2)  $4(\log a^2 - \log b)$
- 3)  $\frac{1}{2}(4 \log a - \log b)$
- 4)  $\frac{1}{4}(2 \log a - \log b)$

24 If  $\log x^2 - \log 2a = \log 3a$ , then  $\log x$  expressed in terms of  $\log a$  is equivalent to

- 1)  $\frac{1}{2} \log 5a$
- 2)  $\frac{1}{2} \log 6 + \log a$
- 3)  $\log 6 + \log a$
- 4)  $\log 6 + 2 \log a$

25  $\log \cot A$  is equivalent to

- 1)  $\log \sin A + \log \cos A$
- 2)  $\log \sin A - \log \cos A$
- 3)  $\log \cos A + \log \sin A$
- 4)  $\log \cos A - \log \sin A$

**A2.A.19: Properties of Logarithms 2: Apply the properties of logarithms to rewrite logarithmic expressions in equivalent forms**

1 The expression  $2\log_5 m + \log_5 n$  is equivalent to

- |                           |                          |
|---------------------------|--------------------------|
| 1) $\log_5 m^2 n$         | 3) $\log_5 \sqrt{mn}$    |
| 2) $\log_5 \frac{m^2}{n}$ | 4) $\log_5 \frac{2m}{n}$ |

2 The expression  $2\log x - 3\log y$  is equivalent to

- |                         |                                   |
|-------------------------|-----------------------------------|
| 1) $\log \frac{2x}{3y}$ | 3) $\log \frac{x^2}{y^3}$         |
| 2) $\log x^2 y^3$       | 4) $\frac{2}{3} \log \frac{x}{y}$ |

3 The expression  $2\log x - (3\log y + \log z)$  is equivalent to

- |                             |                          |
|-----------------------------|--------------------------|
| 1) $\log \frac{x^2}{y^3 z}$ | 3) $\log \frac{2x}{3yz}$ |
| 2) $\log \frac{x^2 z}{y^3}$ | 4) $\log \frac{2xz}{3y}$ |

4 The expression  $\log 10^{x+2} - \log 10^x$  is equivalent to

- |         |                    |
|---------|--------------------|
| 1) $-2$ | 3) $100$           |
| 2) $2$  | 4) $\frac{1}{100}$ |

5 The expression  $\frac{1}{2}\log m - 3\log n$  is equivalent to

- |                                   |                                 |
|-----------------------------------|---------------------------------|
| 1) $\log \sqrt{m} + \log n^3$     | 3) $\log \frac{m^2}{3\sqrt{n}}$ |
| 2) $\log \frac{1}{2} m + 3\log n$ | 4) $\log \frac{\sqrt{m}}{n^3}$  |

6 The expression  $\frac{1}{3} \log a - 3 \log b$  is equivalent to

1)  $\log(\sqrt[3]{a} - b^3)$

3)  $\log \frac{\sqrt[3]{a}}{b^3}$

2)  $\log \frac{a}{3b^3}$

4)  $\log \frac{\sqrt[3]{a}}{3b}$

7 The expression  $3 \log x - \frac{1}{2} \log y$  is equal to

1)  $\log \frac{x^3}{y^2}$

3)  $\log \sqrt{\frac{3x}{y}}$

2)  $\log \frac{x^3}{\sqrt{y}}$

4)  $\frac{\log 3x}{\frac{1}{2} \log y}$

8 The expression  $\frac{1}{2} \log a - 2 \log b$  is equivalent to

1)  $\log \frac{\sqrt{a}}{b^2}$

3)  $\log \frac{a^2}{\sqrt{b}}$

2)  $\log \sqrt{ab}$

4)  $\log(\sqrt{a} - b^2)$

9 The expression  $\frac{1}{3} \log m - 2 \log n$  is equivalent to

1)  $\log \left( \frac{1}{3} m - 2n \right)$

3)  $\log(\sqrt[3]{m} - n^2)$

2)  $\log \left( \frac{m^3}{\sqrt{n}} \right)$

4)  $\log \frac{\sqrt[3]{m}}{n^2}$